Driveway Permitting and Traffic Impact Study Review Overview

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NCDOT Congestion Management

Driveway Permits

- Needed for access to State Hwy. System
- "Driveway Manual" is policy on driveway accesses

  http://www.ncdot.org/doh/preconstruct/altern//value/manuals/pos.pdf

The Department of Transportation may establish policies and adopt rules about the size, location, direction of traffic flow, and the construction of driveway connections into any street or highway which is a part of the State Highway System. The Department of Transportation may require the construction and public dedication of acceleration and deceleration lanes, and traffic storage lanes and medians by others for the driveway connections into any United States route, or North Carolina route, and on any secondary road route with an average daily traffic volume of 4,000 vehicles per day or more.

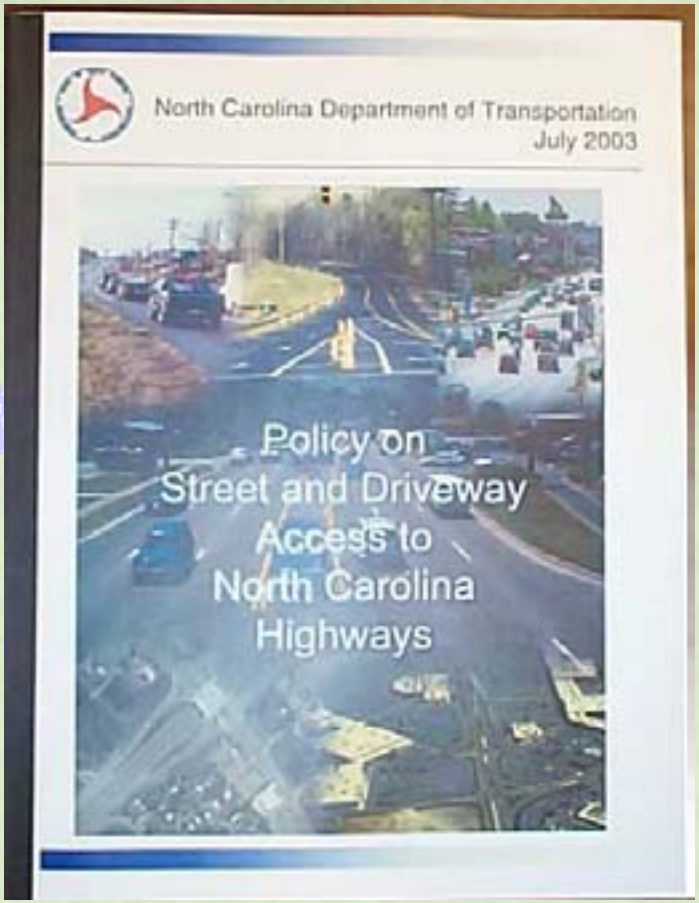
N.C.G.S. 136-18 (29)

Purpose of the Driveway Manual

Provide for the **safe** and **efficient** movement of people and goods by establishing requirements for the location, design, and construction of street and driveway access connections to the state highway system.

What is in the Driveway Manual?

- Permit procedures and requirements
- Parties involved
- Elements needed for studies and site plans
- Access design criteria



Why do we have street and driveway policies?

What an Engineer Sees

Why do we have street and driveway policies?

What a Politician Sees

Why do we have street and driveway policies?

This is What We Have to Deal With

Permitting Process

- Developer request
- NCDOT District Engineer responsible
- Concurrent municipal and/or county government review and approval
- Review of preliminary site plan
- Pre-submittal conference encouraged

Permitting Process

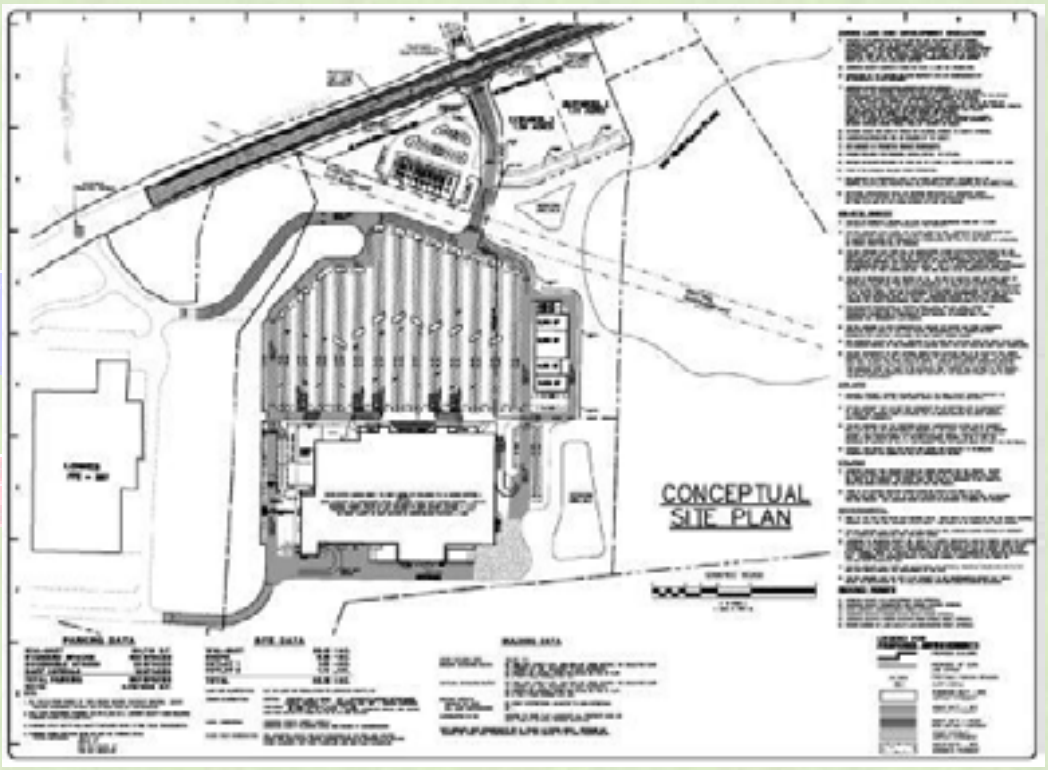
- Is a Traffic Impact Assessment (TIA) needed?
  - >3,000 trips/day
  - Near an interchange
  - On a Strategic Hwy. Corridor
  - On a TIP project
  - Zoning change
  - Varies from Comprehensive Transportation Plans
- Traffic Engineering Branch involvement
- Joint review of site plan and/or TIA
- Permit issued once all issues resolved
- Appeals process

Process Stakeholders

- Developers
- Private firms (site plans and TIAs)
- NCDOT
  - District/Division
  - Traffic Engineering Branch
  - Roadway Design
  - Project Development and Environmental Analysis Branch (TIP Projects)
  - Transportation Planning Branch
- Municipal and/or County Authorities
- Nearby Developments

Site Plan Attributes

- Full-size, to scale
- Number, size, and types of land uses of the development
- Anything within 500’ of proposed property
  - ROW and C/A
  - Driveways
  - Intersecting roads
  - Crossovers
  - Signals
  - Railways

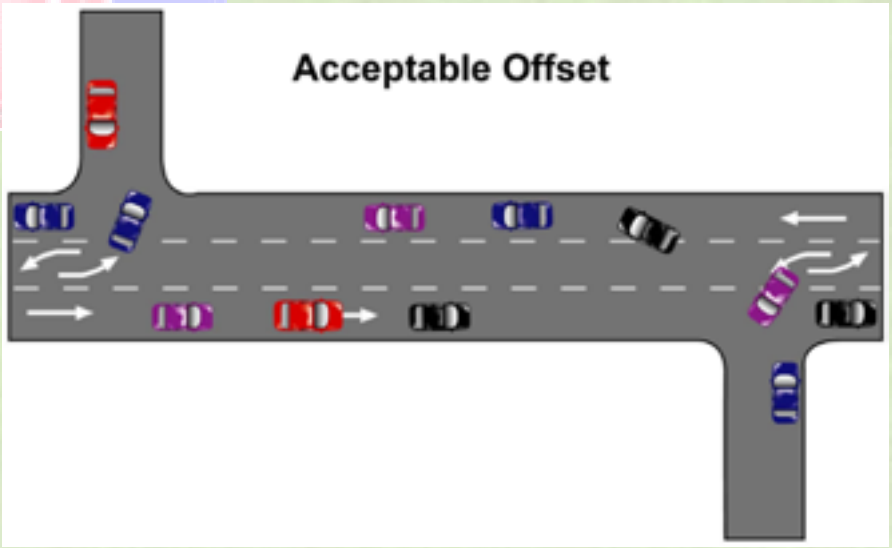


Driveway Access Criteria

- Driveway separation between centerlines
  - Smaller developments, corner clear distance of 100’ min.
  - High traffic generating developments, all-movement driveways 600’ min.
  - On routes with safety or operational problems, left-turn accesses 1,000’ or more
- Allows better management of traffic and improves safety (fewer conflict points and separation between conflict points)

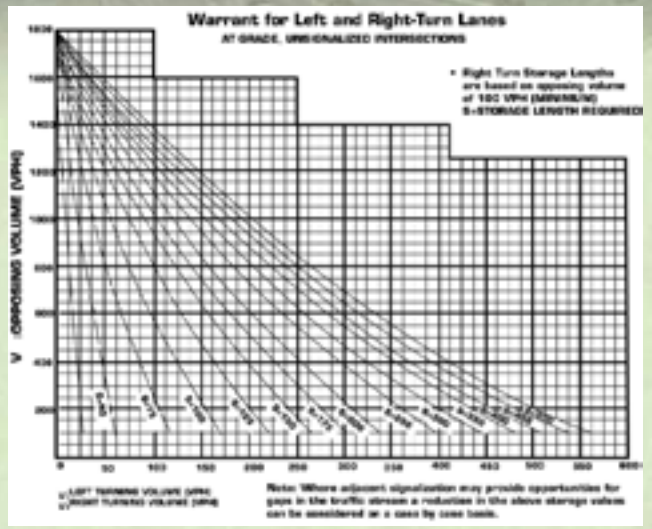
Driveway Access Criteria

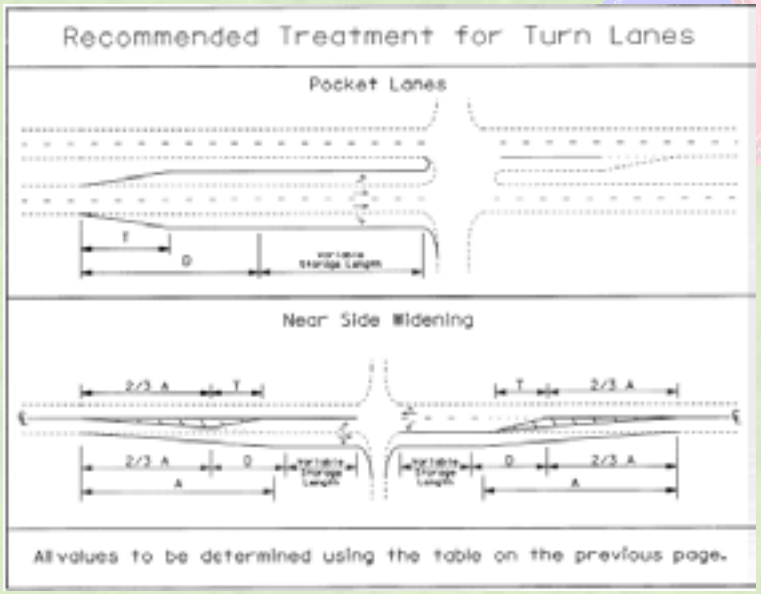
- Avoid poorly offset roadways
- Check for control of access breaks
- Check for median breaks

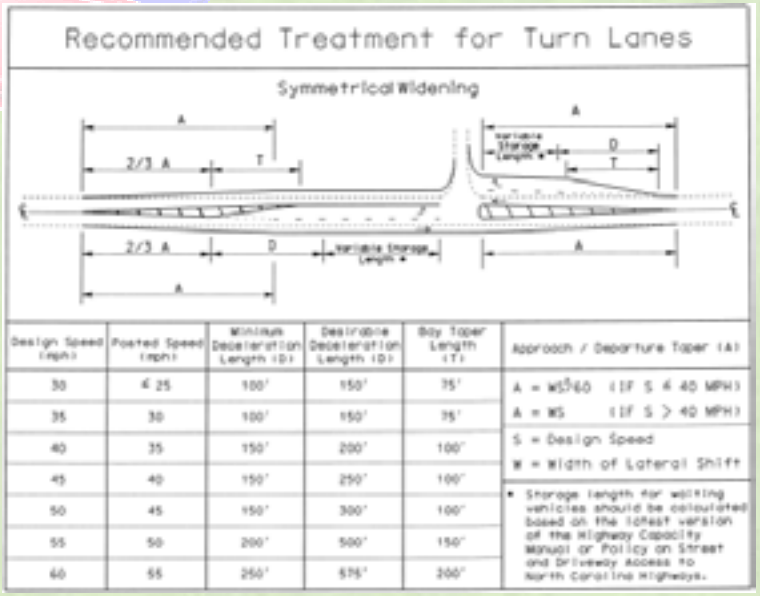


Driveway Access Criteria

- Provides adequate turning lanes
- Design criteria in the driveway manual
- Nomograph for turn lanes

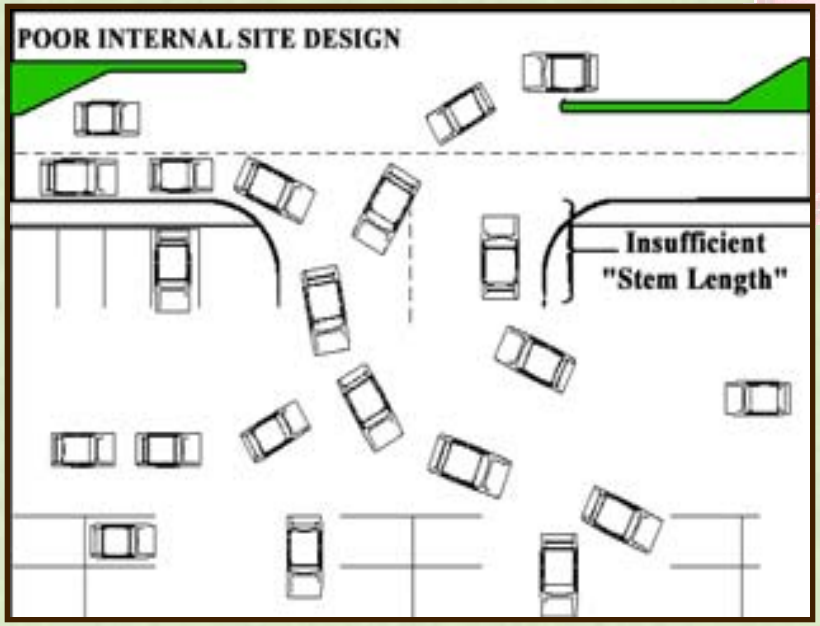


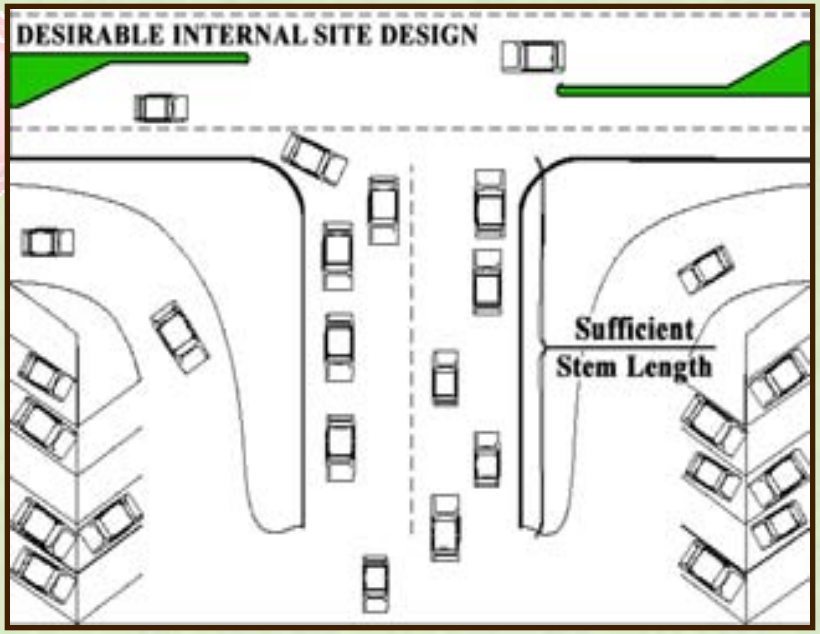




Driveway Access Considerations

- Provide adequate internal protected storage (a.k.a. stem length)
- Check for adequate internal circulation
- Connectivity to adjacent properties



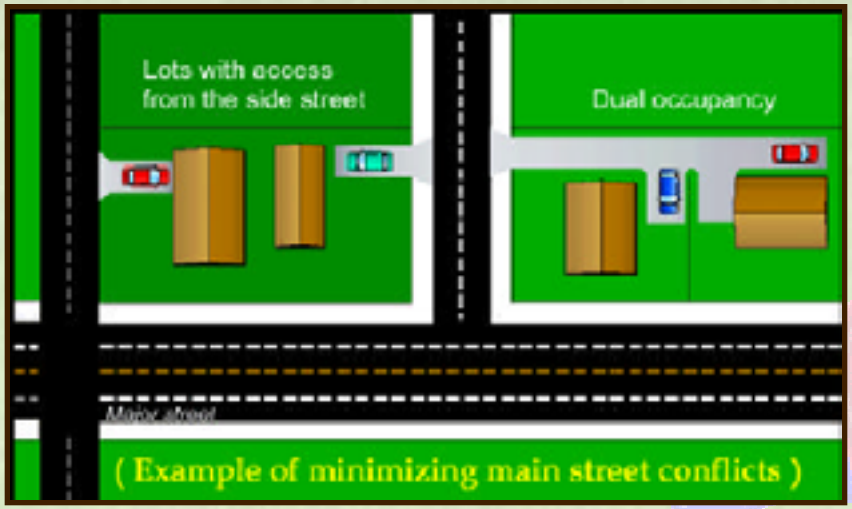


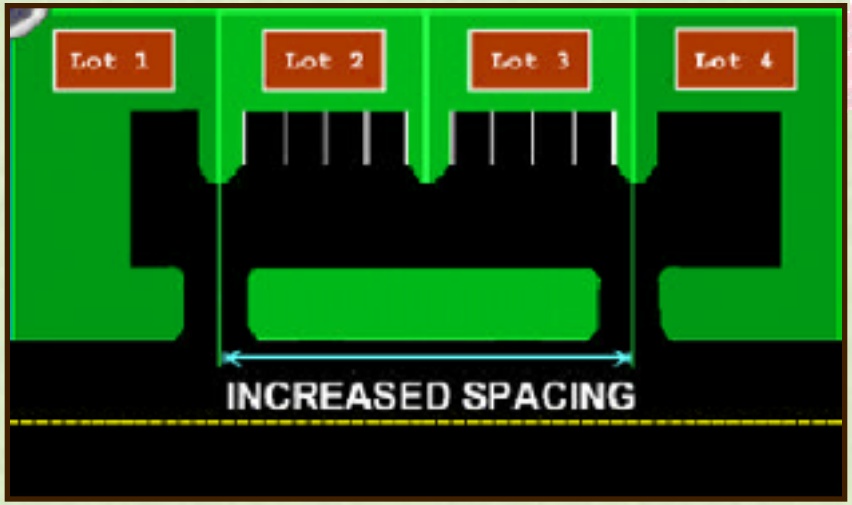
Driveway Access Considerations

Unacceptable I.P.S.

Acceptable I.P.S.

Driveway Access Considerations

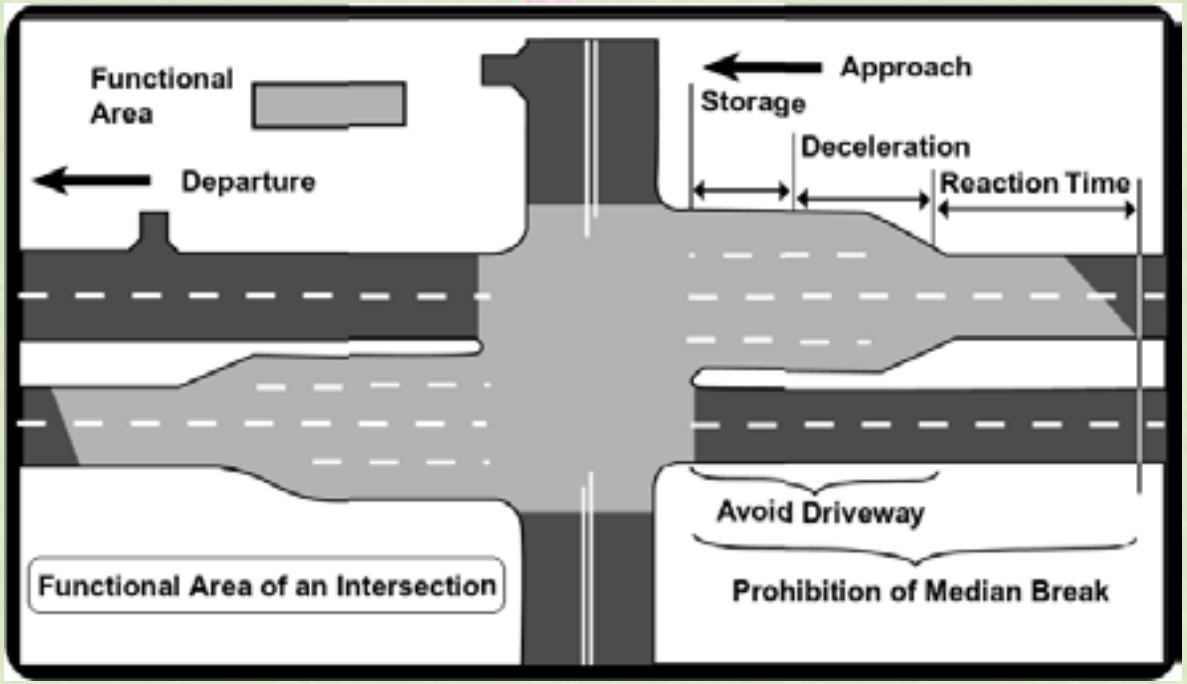




- NCDOT may restrict or prohibit access to any state system roadway if alternate access is available to another adjacent facility
- Normally one driveway will be allowed per property frontage

Driveway Access Considerations

- Avoid functional area of adjacent intersections

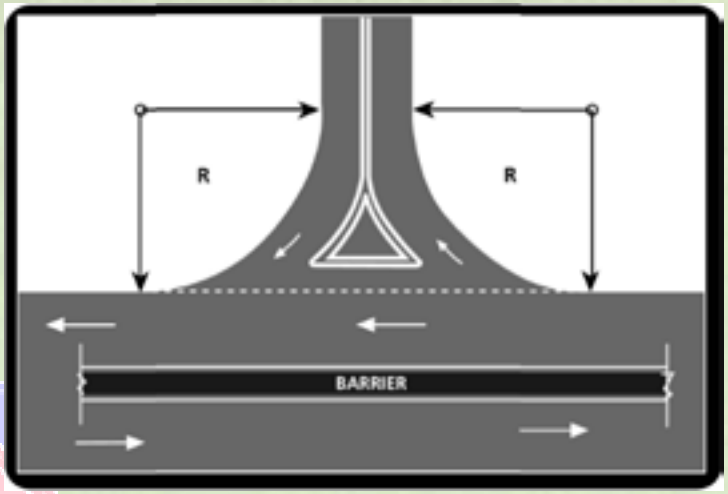


Driveway Access Considerations

- Out-lots/outparcels should be served internally where possible
- Provides/encourages connectivity
- Minimizes external repetitive trips

Driveway Access Options

- All-movement
- Median U-turn/Superstreet
- Directional crossover
- Right-in/Right-out (RIRO)
- No access/consolidate



Driveway Access Control

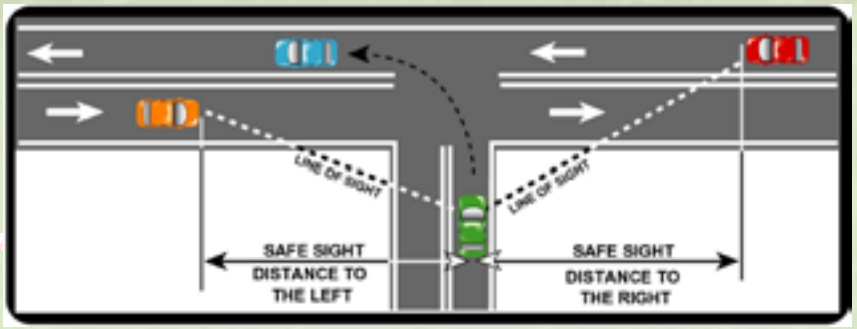
- Stop/yield controlled or traffic signal
- Alternatives to conventional signalization
  - Roundabouts
  - Distribute access points (e.g. side streets, adjacent accesses)
  - Median U-turns/superstreets (reduce signal phases)
  - Grade separation/interchanges (larger developments)

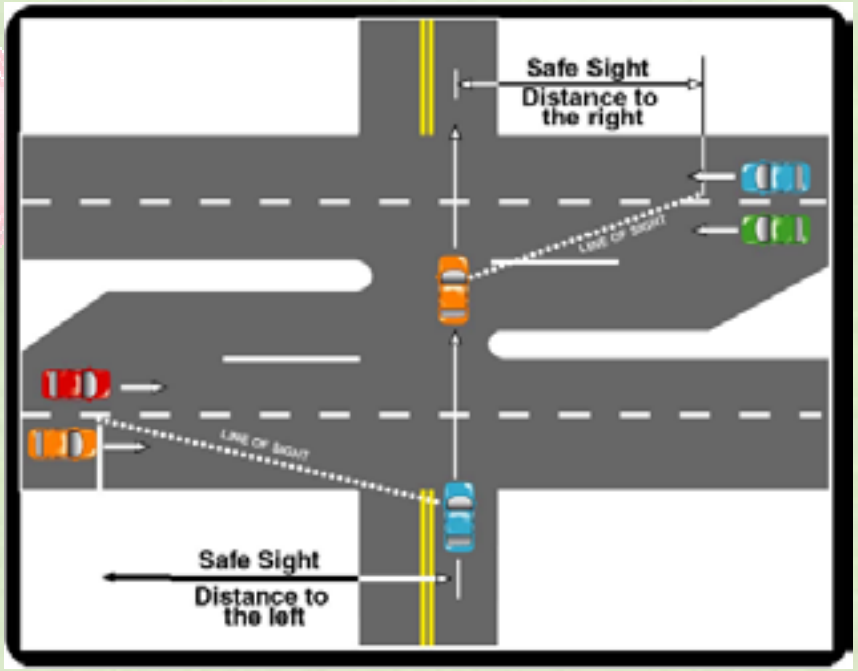
Dedication of ROW

- Applicant responsible for providing ROW to contain needed improvements
  - Auxiliary lanes for site traffic
  - Traffic control devices
  - Sight distance areas
  - Drainage facilities
  - Others?

Sight Distance

- Applicant required to dedicate a sight distance easement at driveway connections to the public roadway





Site Review Considerations

- Careful consideration needs to be given to:
  - Number of access points
  - Location of access points (C/A limits?)
    - Consult access management guidelines and driveway permitting requirements
  - Location of median breaks (guidelines)
  - Strategic Highway Corridors (guidelines)
  - Driveway restrictions
    - e.g., left-over, right-in/right-out movements only
  - Parking layout
  - Internal circulation, internal protected storage
  - Connectivity between properties

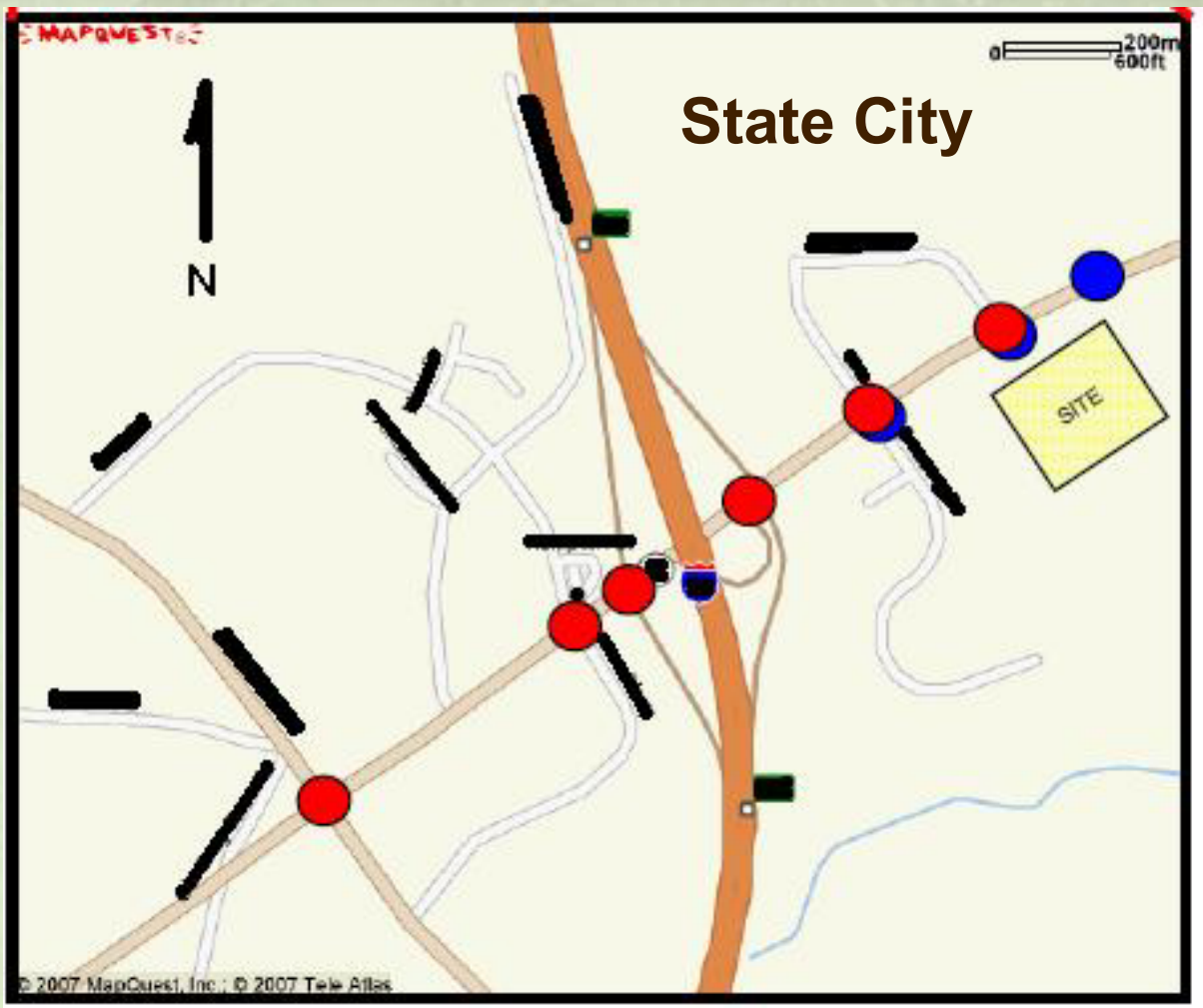
Traffic Impact Assessments (TIA)

- A.k.a Traffic Impact Studies (TIS)
- “A specialized study that evaluates the effects of a developent’s traffic on the surrounding transportation infrastructure” --Driveway Manual
- Helps stakeholders identify significant safety, traffic, and transportation impacts to the vicinity
- Purpose to provide **safe** and **efficient** access and traffic flow

TIA Attributes

- TIA and review recommendations sealed by a Professional Engineer
- Key segments
  - Introduction
  - Base (Existing) Conditions
  - Background (Future No Build) Conditions
  - Project (Future Build-out) Conditions (Multiple Scenarios)
  - Recommendations/Conclusions
  - Appendix (Supporting Information)
- Includes all analyses (files), traffic volume figures, and lane geometry figures for each condition

Typical Vicinity Map



Legend

= Existing Study Area Intersection

= Site Driveway Intersection

Traffic Volume Calculations

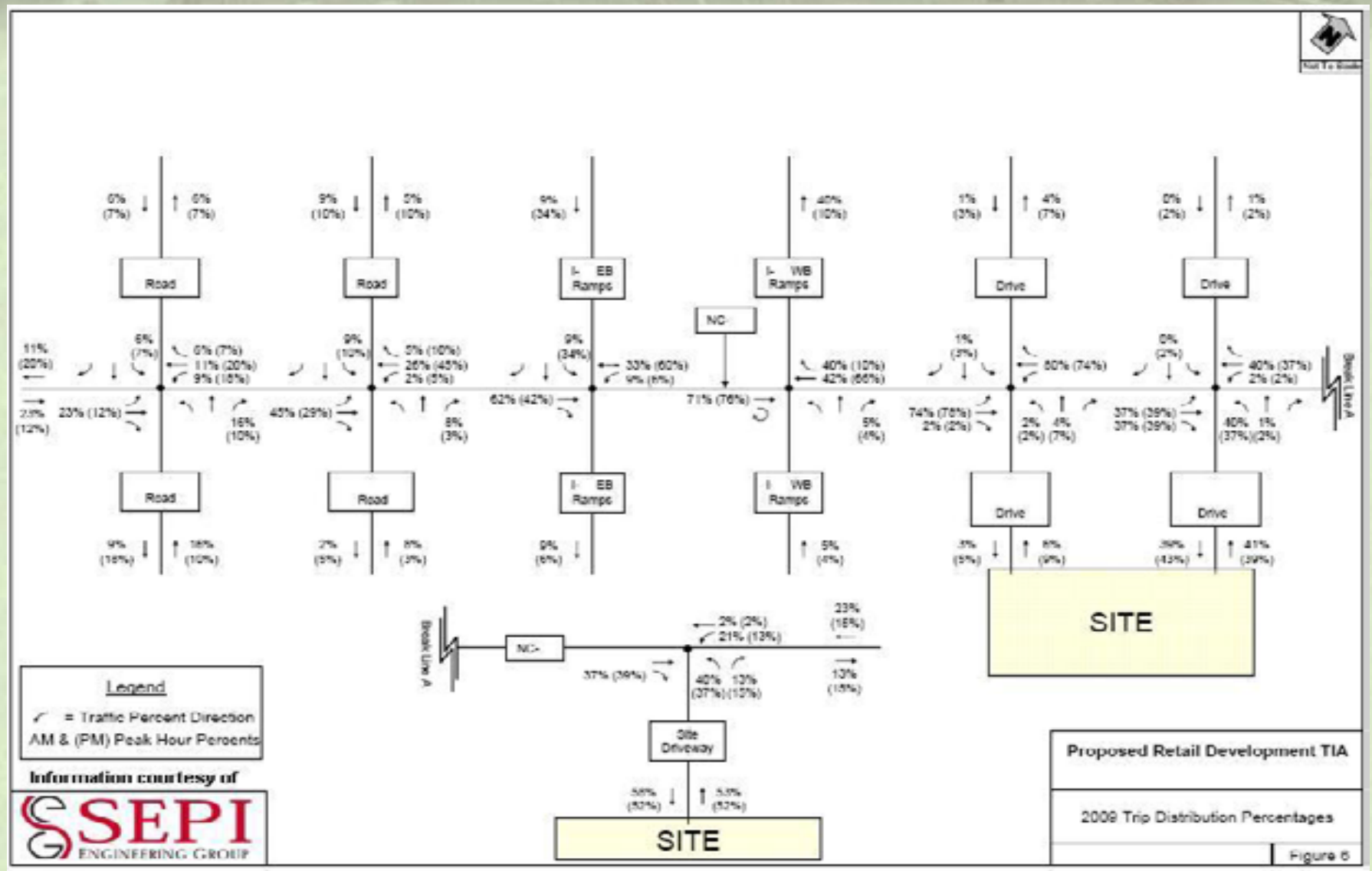
- Background traffic (future no build)
  - Traffic counts + growth + approved development
  - TIP projections
  - Regional traffic model
- Includes traffic volumes generated by major approved or proposed developments
- Project traffic (future build-out) includes trip generation for proposed development
  - Pass-by and/or internal capture adjustments
  - Distribution of traffic through each intersection

Typical Trip Generation Table

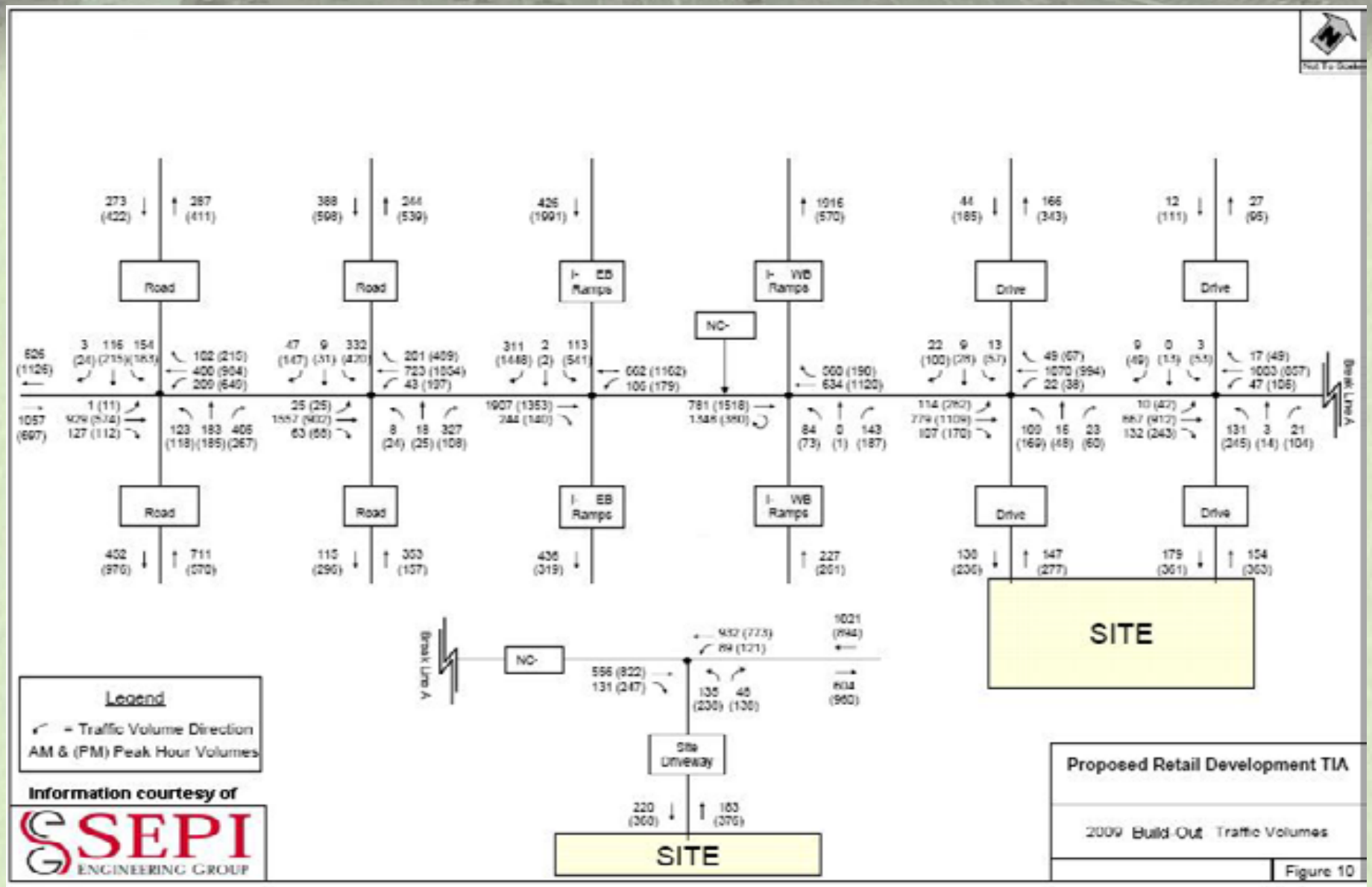
Table ES-3 – Trip Generation Summary (Vehicles / Hour)

ITE Land Use Code	Square Footage	Daily			AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total	In	Out	Total
813 – Free-Standing Discount Superstore	195,000 SF	4,798	4,798	9,596	183	176	359	370	385	755
820 – Shopping Center	43,560 SF	1,979	1,979	3,958	58	37	95	174	188	362
912 – Drive-In Bank	4,000 SF	493	493	986	28	22	50	91	91	182
934 – Fast Food Restaurant with Drive Through Window	4,000 SF	992	992	1,984	108	104	212	72	67	139
SUBTOTAL		8,262	8,262	16524	377	339	716	707	731	1,438
SUPERSTORE PASS-BYS		-	-	-	-	-	-	-104	-108	-212
SHOPPING CENTER PASS-BYS		-	-	-	-	-	-	-59	-64	-123
DRIVE-IN BANK PASS-BYS		-	-	-	-	-	-	-43	-43	-86
RESTAURANT PASS-BYS		-	-	-	-53	-51	-104	-36	-34	-70
TOTAL		8,262	8,262	16524	324	288	612	465	482	947

Typical Trip Distribution Figure



Typical Volumes Figure



TIA Results

- Level of Service (LOS) and Queuing determined by HCM procedures
  - Signalized intersections (Synchro)
  - Unsignalized intersections (Including Driveways)
  - Roundabouts (SIDRA)
  - Network microsimulation (SimTraffic)
  - Arterial segments
  - Freeway and ramp segments

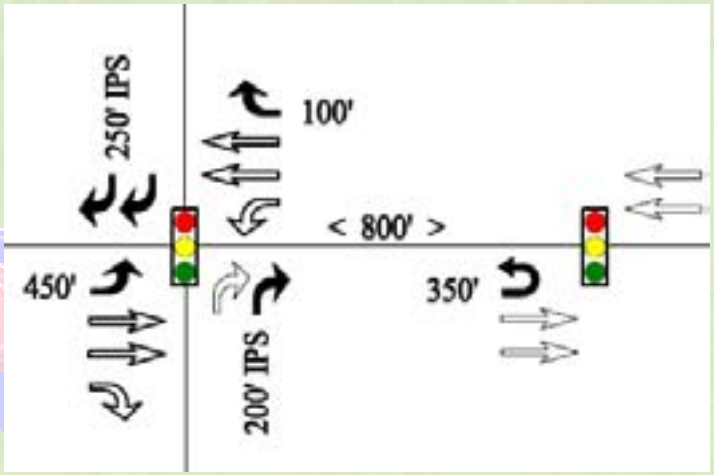
Typical LOS Analysis Results

Table ES-2 – Level of Service Results – Study Area Intersections

	Condition 1		Condition 2		Condition 3		Condition 4		Condition 5	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
SR 1111 (Main Street) and NC 1	E	E	F	F	F	F	F	F	F	F
NB LT	F	F	F	F	F	F	F	F	F	F
NB TH	F	F	F	F	F	F	F	F	F	F
NB RT	D	B	E	B	F	C	F	C	F	C
SB LT	E	E	E	E	F	F	F	F	F	F
SB THRT	D	D	D	E	D	E	D	E	E	F
EB LT	B	C	B	C	B	D	B	E	B	D
EB THRT	E	F	F	F	F	F	F	F	F	F
WB LT	F	F	F	F	F	F	F	F	E	F
WB TH	B	B	B	C	B	C	B	D	A	A
WB RT	A	A	A	A	A	A	A	A	A	A
SR 1111 (Main Street) and SR 9999 (Second Street)/Proposed Driveway	E	E	F	F	F	F	F	F	F	F
NB THLT	E	E	E	E	E	E	E	E	E	F
NB RT	B	B	C	B	E	B	F	B	F	C
SB LT	F	F	F	F	F	F	F	F	F	F
SB THRT	B	C	B	D	B	D	B	D	B	E
EB LT	C	F	D	F	D	F	D	F	C	F
EB THRT	F	E	F	F	F	F	F	F	F	E
WB LT	D	B	E	B	F	F	F	F	F	E
WB THRT	A	D	A	F	A	F	A	F	A	F
I-99 Northbound Ramps and NC 1	C	D	E	F	F	F	F	F	E	F
SB THLT	E	F	E	F	F	F	F	F	F	F
SB RT	A	C	A	E	A	F	A	F	A	F
EB THRT	B	B	F	D	F	F	F	F	E	C
WB LT	E	C	F	D	F	F	F	F	F	F
WB TH	D	F	D	F	D	F	D	F	D	F

Common Roadway Improvements

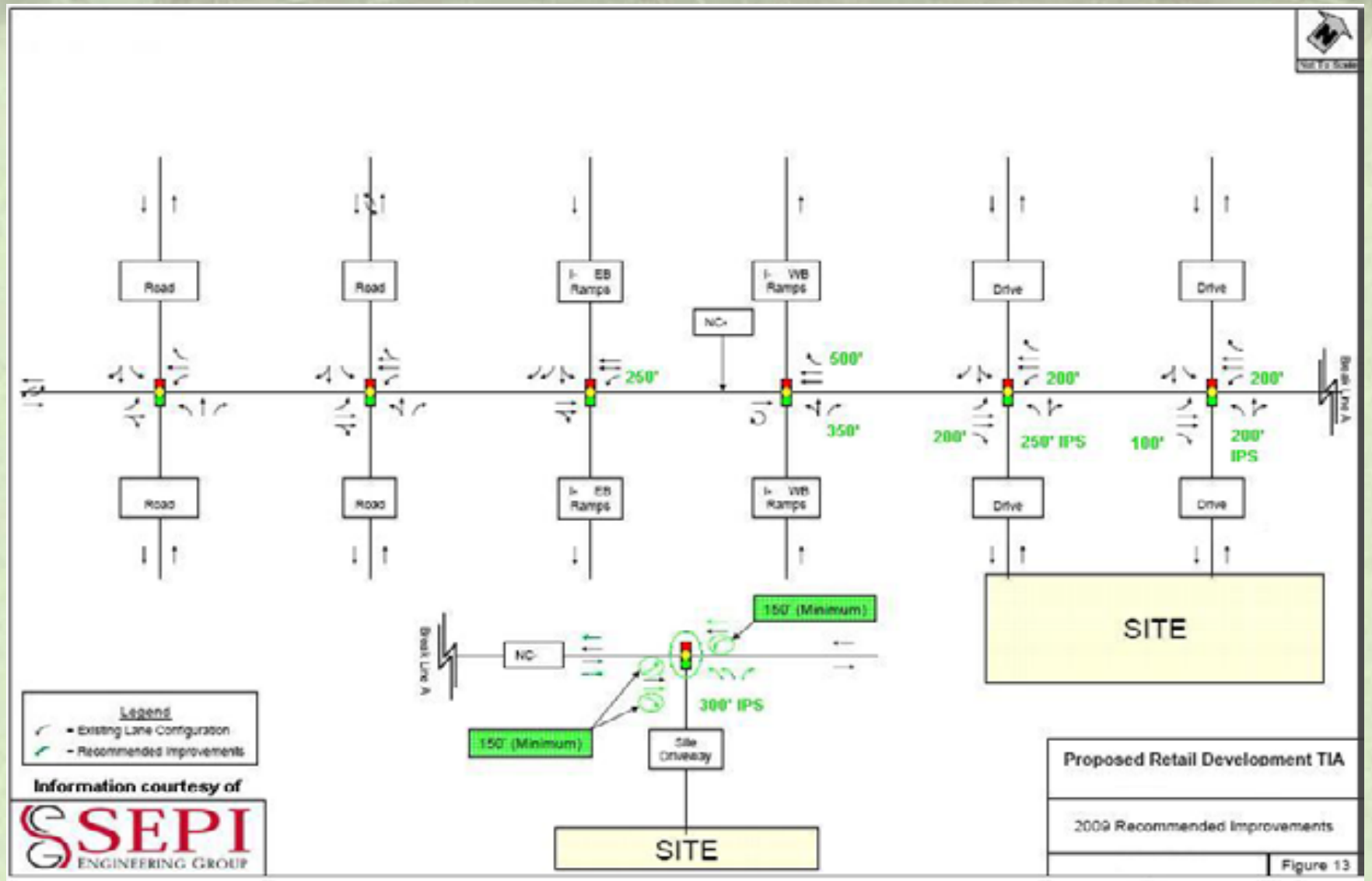
- May or may not be immediately adjacent to the property
- Intersection improvements
  - Traffic signals
  - Roundabouts
  - Superstreets
  - Grade separation
- Add/extend travel lanes
- Adjust lane configuration
- Interchange modifications
  - Adding a loop
- Median/channelization (access restrictions)
- New or upgraded traffic signals
  - Signal system coordination
  - Re-time signal phases/cycles



TIA Recommendations/ Conclusions

- Applicant (TIA) required to identify improvements when: (base to project)
  - avg. intersection delay increases 25% or more
  - int. approach delay increases 25% or more
  - LOS degrades by at least one level
  - LOS is “F”
  - 95th percentile queue exceeds storage capacity
- Developer improvements vs. improvements by “others”
  - Site-mitigated
  - Other developments
  - TIP/local roadway projects
  - Funded jointly

Planned and Programmed Improvements



TIA - Appendix

- TIA shall include all supporting information including, but not limited to:
  - Traffic counts
  - Trip generation calculations and adjustments
  - Scoping agreements
  - Analysis reports
  - Approved development information
  - Proposed roadway improvements by others

Sample Synchro File Output

Lanes, Volumes, Timings
4: NC 999 (Main Street) & US 99 SB On Ramp 4/23/2008

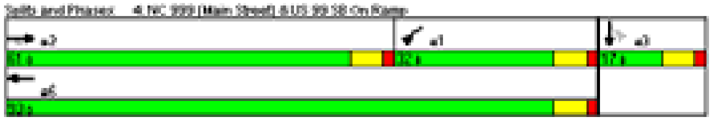
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	763	327	178	812	0	0	0	0	97	4	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		1000	500		0	0		0	0		0
Storage Lanes	0		1	1		0	0		0	1		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850								0.861	
Flt Protected				0.950						0.950		
Satd. Flow (prot)	0	1863	1583	1770	1863	0	0	0	0	1736	1573	0
Flt Permitted				0.950						0.950		
Satd. Flow (perm)	0	1863	1583	1770	1863	0	0	0	0	1736	1573	0
Right Turn on Red			No			No			No			No
Satd. Flow (RTOR)												
Link Speed (mph)		35			35			45			45	
Link Distance (ft)		1490			321			916			393	
Travel Time (s)		29.0			10.1			13.9			5.0	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	4%	4%	4%
Adj. Flow (vph)	0	848	363	198	902	0	0	0	0	108	4	49
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	848	363	198	902	0	0	0	0	108	53	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type			Perm	Prot						Perm		
Protected Phases		2		1	6						3	
Permitted Phases			2							3		
Detector Phase		2	2	1	6					3	3	
Switch Phase												
Minimum Initial (s)		10.0	10.0	7.0	10.0					7.0	7.0	
Minimum Split (s)		17.0	17.0	17.0	17.0					17.0	17.0	
Total Split (s)	0.0	61.0	61.0	32.0	93.0	0.0	0.0	0.0	0.0	17.0	17.0	0.0
Total Split (%)	0.0%	55.5%	55.5%	29.1%	84.5%	0.0%	0.0%	0.0%	0.0%	15.5%	15.5%	0.0%
Maximum Green (s)		54.0	54.0	25.0	86.0					10.0	10.0	
Yellow Time (s)		5.0	5.0	5.0	5.0					5.0	5.0	
All-Red Time (s)		2.0	2.0	2.0	2.0					2.0	2.0	
Lost Time Adjust (s)	1.0	-2.0	-2.0	-2.0	-2.0	1.0	1.0	1.0	1.0	-2.0	-2.0	1.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead	Lead	Lag								
Lead-Lag Optimize?		Yes	Yes	Yes								
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Recall Mode		C-Min	C-Min	None	C-Min					None	None	
Act Effct Green (s)		62.5	62.5	19.5	87.0					13.0	13.0	

Lanes, Volumes, Timings
4: NC 999 (Main Street) & US 99 SB On Ramp 4/23/2008

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio		0.57	0.57	0.18	0.79					0.12	0.12	
v/s Ratio		0.80	0.40	0.63	0.61					0.53	0.28	
Control Delay		27.8	16.3	47.4	5.9					54.9	47.8	
Queue Delay		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	
Total Delay		27.8	16.3	47.4	6.9					54.9	47.8	
LOS		C	B	D	A					D	D	
Approach Delay		24.4			14.2						52.6	
Approach LOS		C			B						D	
Queue Length 50th (ft)		[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	
Queue Length 95th (ft)		#709	235	m109	276					130	75	
Internal Link Dist (ft)		1410			441			836			305	
Turn Bay Length (ft)			1000	500								
Base Capacity (vph)		1059	900	434	1409					214	193	
Starvation Cap Reductn		0	0	0	328					0	0	
Spillback Cap Reductn		0	0	0	0					0	0	
Storage Cap Reductn		0	0	0	0					0	0	
Reduced v/c Ratio		0.80	0.40	0.46	0.77					0.50	0.27	

Intersection Summary
Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 21.7 Intersection LOS: C
Intersection Capacity Utilization 81.1% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: NC 999 (Main Street) & US 99 SB On Ramp



Sample SimTraffic Output

Queuing and Blocking Report
Baseline

4/23/2008

Intersection: 3: NC 999 (Main Street) & US 99 NB Off Ramp

Movement	EB	EB	WB	NB	NB	SS
Directions Served	L	T	TR	L	TR	T
Maximum Queue (ft)	92	499	606	406	326	217
Average Queue (ft)	34	134	333	210	136	8
95th Queue (ft)	73	417	565	344	273	72
Link Distance (ft)		476	960	334	334	323
Upstream Blk Time (%)			1		2	0
Queuing Penalty (veh)			7		4	0
Storage Bay Dist (ft)	500					
Storage Blk Time (%)			1			
Queuing Penalty (veh)			1			

Intersection: 4: NC 999 (Main Street) & US 99 SB On Ramp

Movement	EB	EB	WB	WB	SB	SB
Directions Served	T	R	L	T	L	TR
Maximum Queue (ft)	767	717	240	200	162	99
Average Queue (ft)	398	284	126	101	71	40
95th Queue (ft)	653	571	207	255	135	86
Link Distance (ft)	1450			476	316	316
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		1000	500			
Storage Blk Time (%)						
Queuing Penalty (veh)						

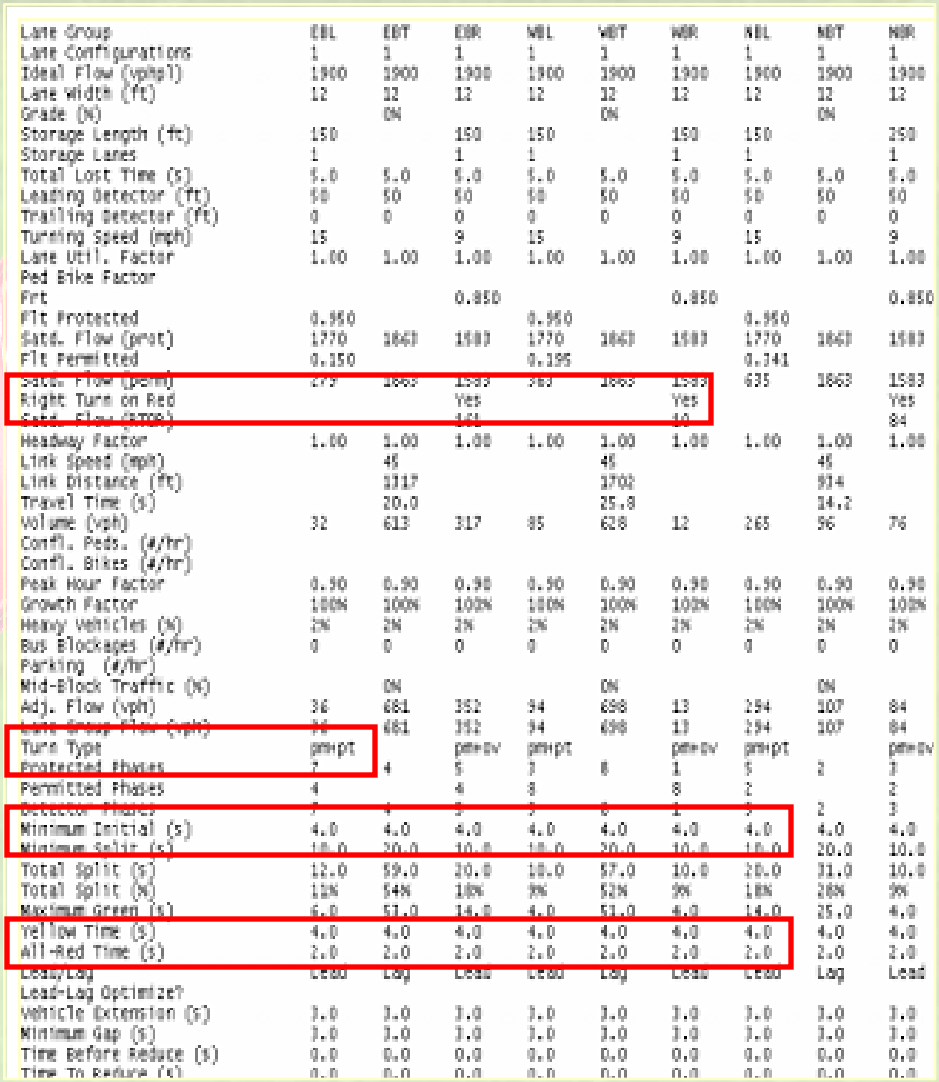
Intersection: 9: Elm Street & SR 9999 (Service Road)

Movement	EB	WB	B14	NB	SB
Directions Served	LTR	LTR	T	LTR	LTR
Maximum Queue (ft)	45	144	221	337	93
Average Queue (ft)	25	131	157	149	25
95th Queue (ft)	39	154	274	318	75
Link Distance (ft)	26	74	206	854	704
Upstream Blk Time (%)	5	96	50		
Queuing Penalty (veh)	3	0	0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Congestion Management Capacity Analysis Guidelines

http://www.ncdot.org/doh/preconstruct/traffic/congestion/CM/

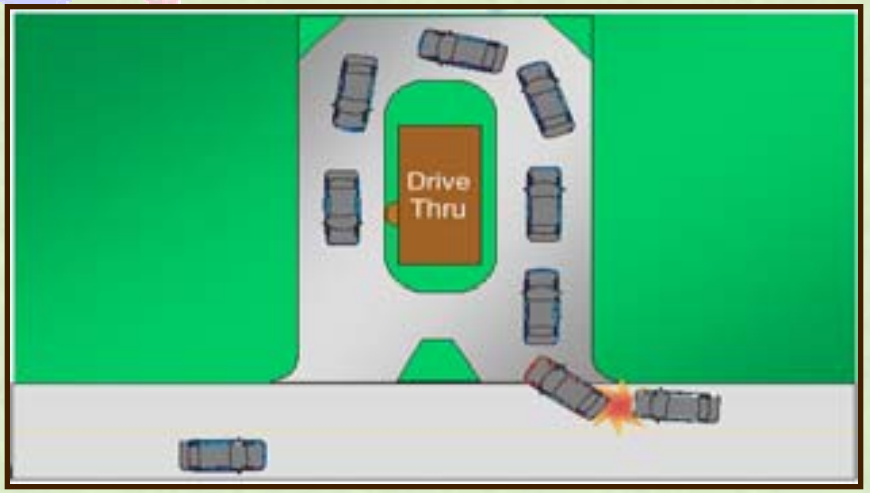
- **Deviations should be justified, documented and approved**
- **Common discrepancies:**
  - Poor levels of service
  - Excessive queuing
  - Left turn protected/permitted
  - Minimum cycle lengths
  - Right turns on red
  - Volumes not balanced
  - Provide storage lengths
  - Lane continuity
  - Minimum green time
  - Yellow/all red time



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR
Lane Configurations	1	1	1	1	1	1	1	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%	
Storage Length (ft)	150		150	150		150	150		250
Storage Lanes	1		1	1		1	1		1
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Leading Detector (ft)	50	50	50	50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor									
Frt			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950		
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.150			0.195			0.741		
Satd. Flow (perm)	279	1863	1583	363	1863	1583	635	1863	1583
Right Turn on Red			Yes			Yes			Yes
Satd. Flow (RTOR)			464			40			84
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Speed (mph)		45			45			45	
Link Distance (ft)		1317			1702			934	
Travel Time (s)		20.0			25.8			14.2	
Volume (vph)	32	613	317	85	628	12	265	96	76
Confl. Peds. (#/hr)									
Confl. Bikes (#/hr)									
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0
Parking (#/hr)									
Mid-Block Traffic (%)		0%			0%			0%	
Adj. Flow (vph)	36	681	352	94	698	13	294	107	84
Lane Group Flow (vph)	36	681	352	94	698	13	294	107	84
Turn Type	pm+pt		pm+ov	pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3
Permitted Phases	4		4	8		8	2		2
Detector Phase	7	4	5	3	8	1	5	2	3
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	20.0	10.0	10.0	20.0	10.0	10.0	20.0	10.0
Total Split (s)	12.0	59.0	20.0	10.0	57.0	10.0	20.0	31.0	10.0
Total Split (%)	11%	54%	18%	9%	52%	9%	18%	28%	9%
Maximum Green (s)	6.0	51.0	14.0	4.0	51.0	4.0	14.0	25.0	4.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?									
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TIA Review Considerations

- Compare TIA to Site Plan
- Scan Synchro and SimTraffic Analysis Files
- Check for items requiring justification or explanation, e.g.:
  - Mitigate Poor Levels of Service
  - Mitigate Excessive Queuing/Spillback
  - Volume Calculations Unclear/Missing
  - Control of Access Break Alternatives
  - Median Break Alternatives
  - Synchro Coding
  - Lane Continuity Concerns
  - Site Plan and/or Electronic Analysis Files



Troubleshooting

- Not providing AM and PM analysis (or mid-day, weekend if needed)
- Allowing short signal cycles (and/or other CM Analysis Guidelines discrepancies)
- Volume calculations/algorithm
- Improper internal capture or pass-by trips
- Holiday or off-peak traffic counts
- Incorrect Trip Generation (land use code, variable)
- Misrepresent background growth resulting in “improvements by others”
- Capacity analysis assumptions

Any Questions ?

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